

	Hash-based approach (2-way-set-associative) Fig. 1	CAM-based approach Fig. 2	H-CAM-based approach (2-way-set-associative) Fig. 8
ASIC output pins	21	128	128
ASIC input pins	160	32	32
RAM size (est. cost)	2M x 160 (\$800)	1M x 32 (\$80)	1M x 32 (\$80)
CAM size (est. cost)	-	1M x 128 (\$3200)	100K x 128 (\$320)
Hash Pointer RAM size (est. cost)	-	-	2M x 20 (\$100)
Search Data RAM size (est. cost)	-	-	1M x 128 (\$320)
Database size (entries) supported	Depends	1M	Depends
Associate content RAM read	2 reads per search	1 read per search	1 read per search
Estimated cost	\$800	\$3280	\$820
Estimated Power consumption	20W	162W	28.5W

Table 1

	Search value (6-digit wide)	Hash 1 output (4-digit wide)	Hash 2 output (2-digit wide)	CAM 1 content	CAM 2 content	Memory content
1	-	-	-	-	-	-
2	324238	7783	63	-	-	-
3	-	-	-	-	-	63: 324238,17
4	578901	6311	63	-	-	63: 324238,17
5	-	-	-	-	100:6311	63: 324238,17 100: 578901,23
6	322413	6311	63	-	100:6311	63: 324238,17 100: 578901,23
7	-	-	-	200:322413	100:6311	63: 324238,17 100: 578901,23 200: -, 86
8	578901	6311	63	200:322413	100:6311	63: 324238,17 100: 578901,23 200: -, 86
9	322413	6311	63	200:322413	100:6311	63: 324238,17 100: 578901,23 200: -, 86
10	324238	7783	63	200:322413	100:6311	63: 324238,17 100: 578901,23 200: -, 86

Table 2

Memory Size and Bandwidth requirement		Old method (Fig. 1)	H-CAM (Fig. 11)
Memory size	Search Data memory	8 million entries	1 million entries
	Hash Pointer memory	none	2M pointers
	Total (Mbit)	1024	164
Memory bandwidth	Reads/search	8	2 per H-CAM

Table 3

TOP SECRET 65572660

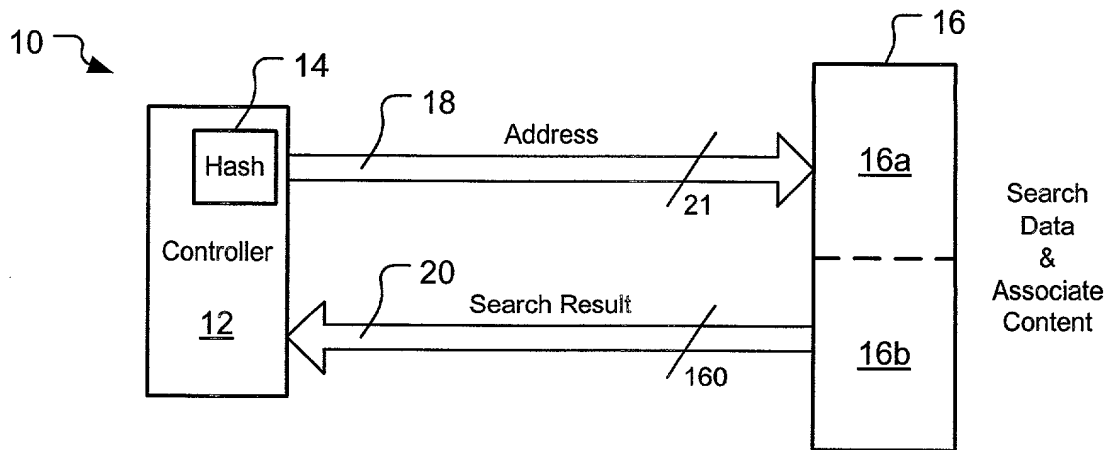


FIG. 1 (background art)

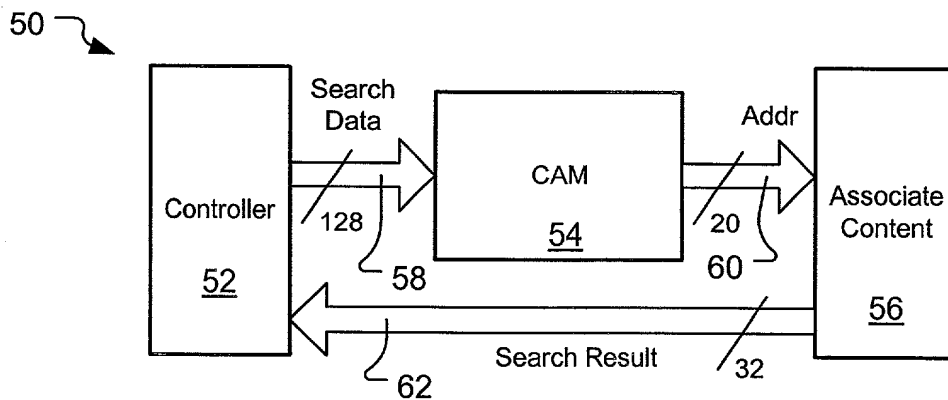


FIG. 2 (background art)

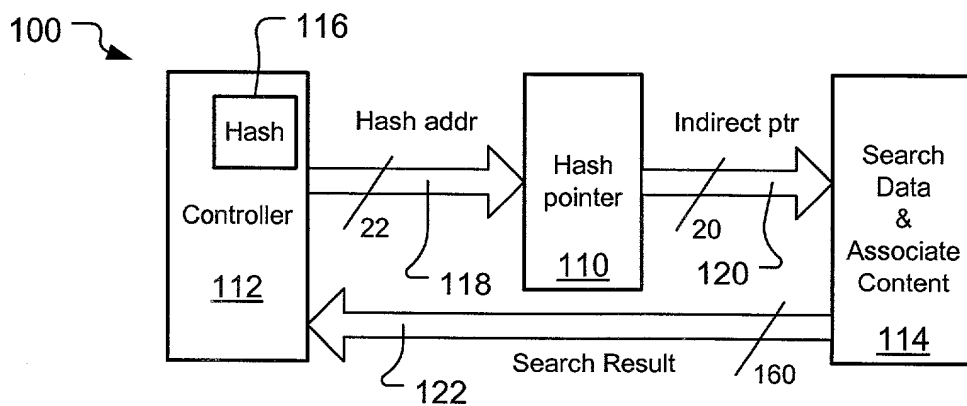


FIG. 3

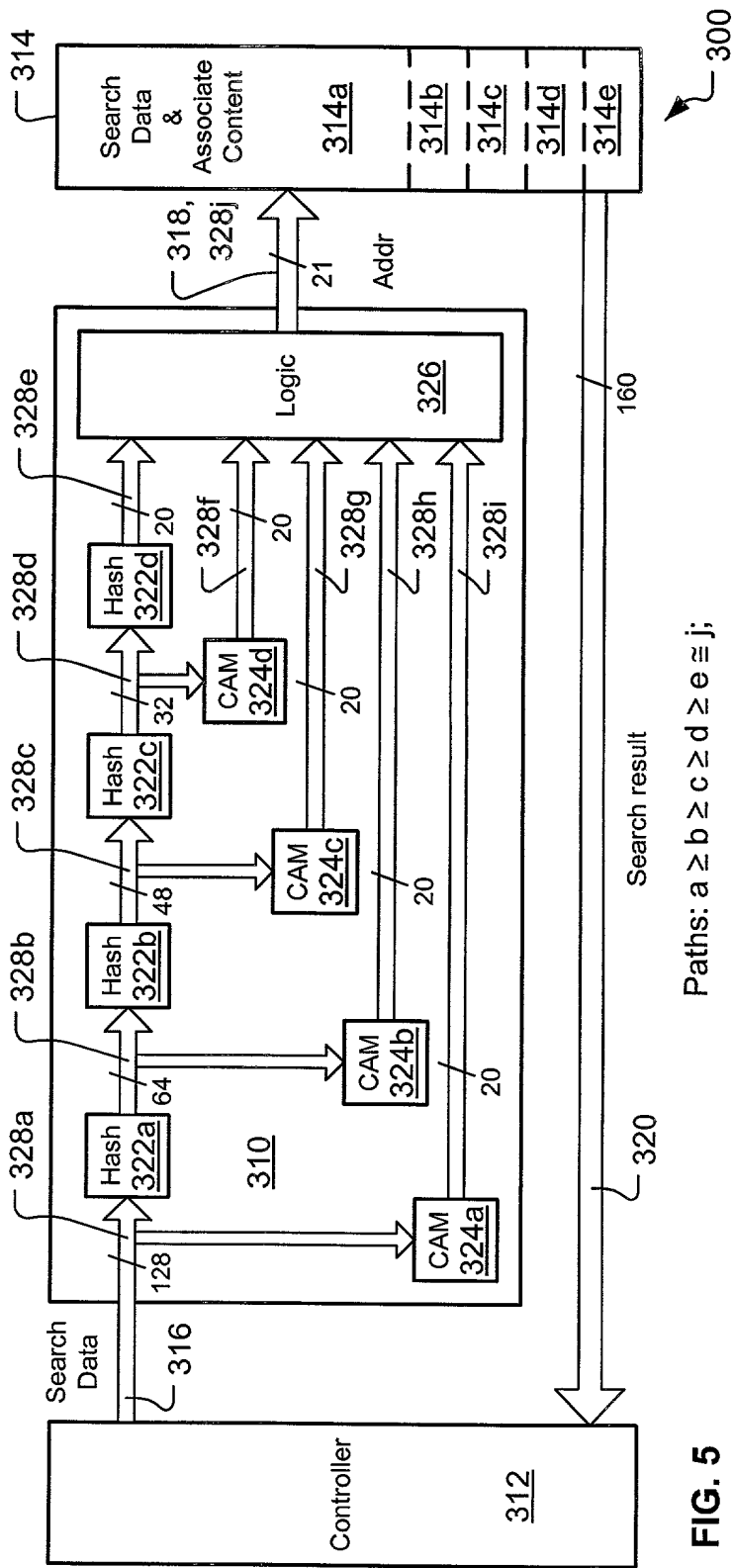
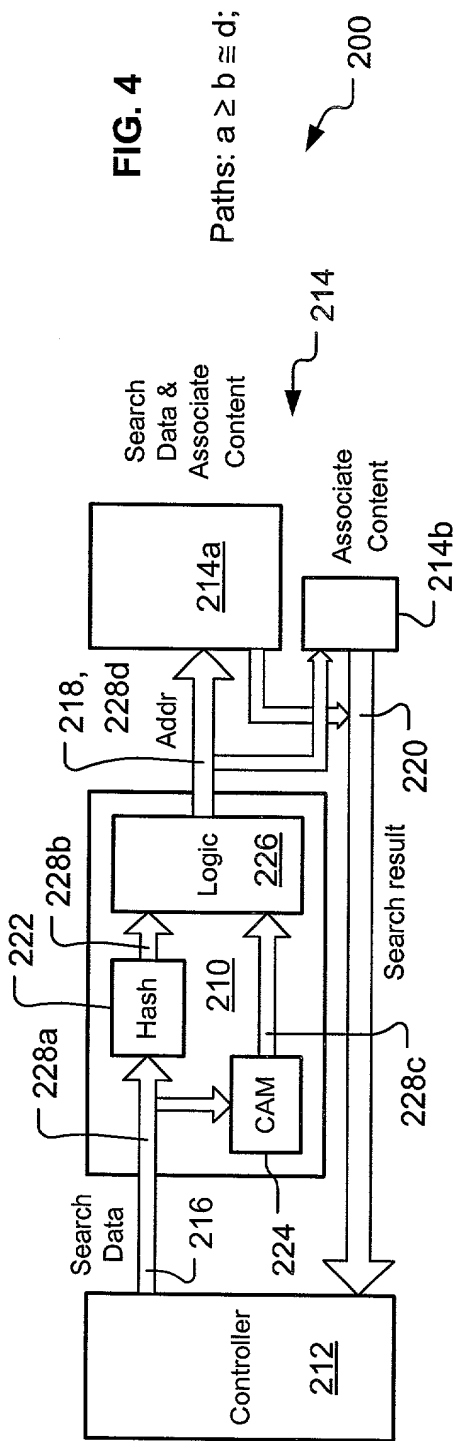
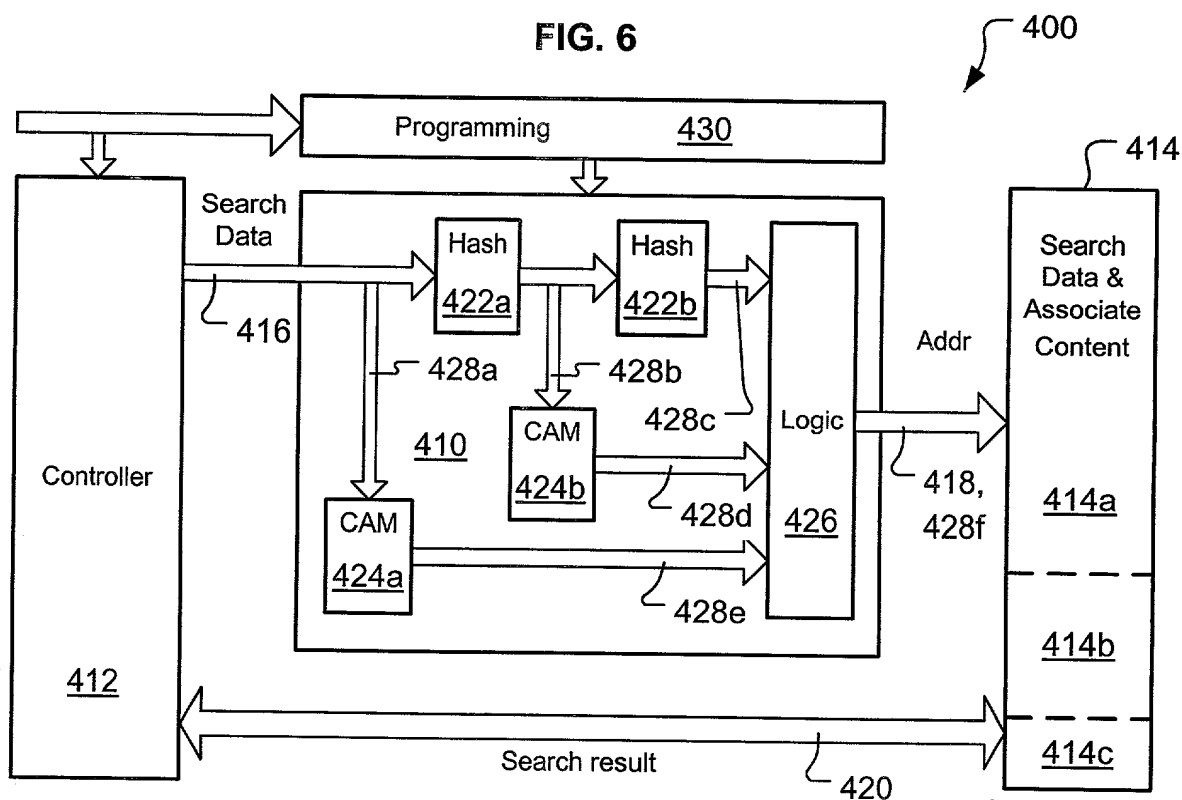


FIG. 6



Paths: $a \geq b \geq c \approx f$;

Search Data and Associate content memory for a 2 level Hash-CAM system. Notice the memory may be composed of five blocks and three distinct sections.

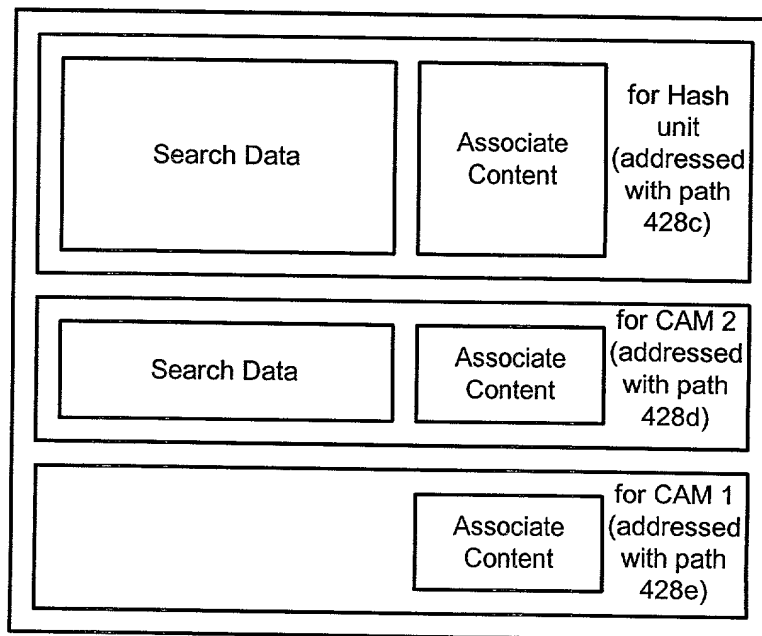
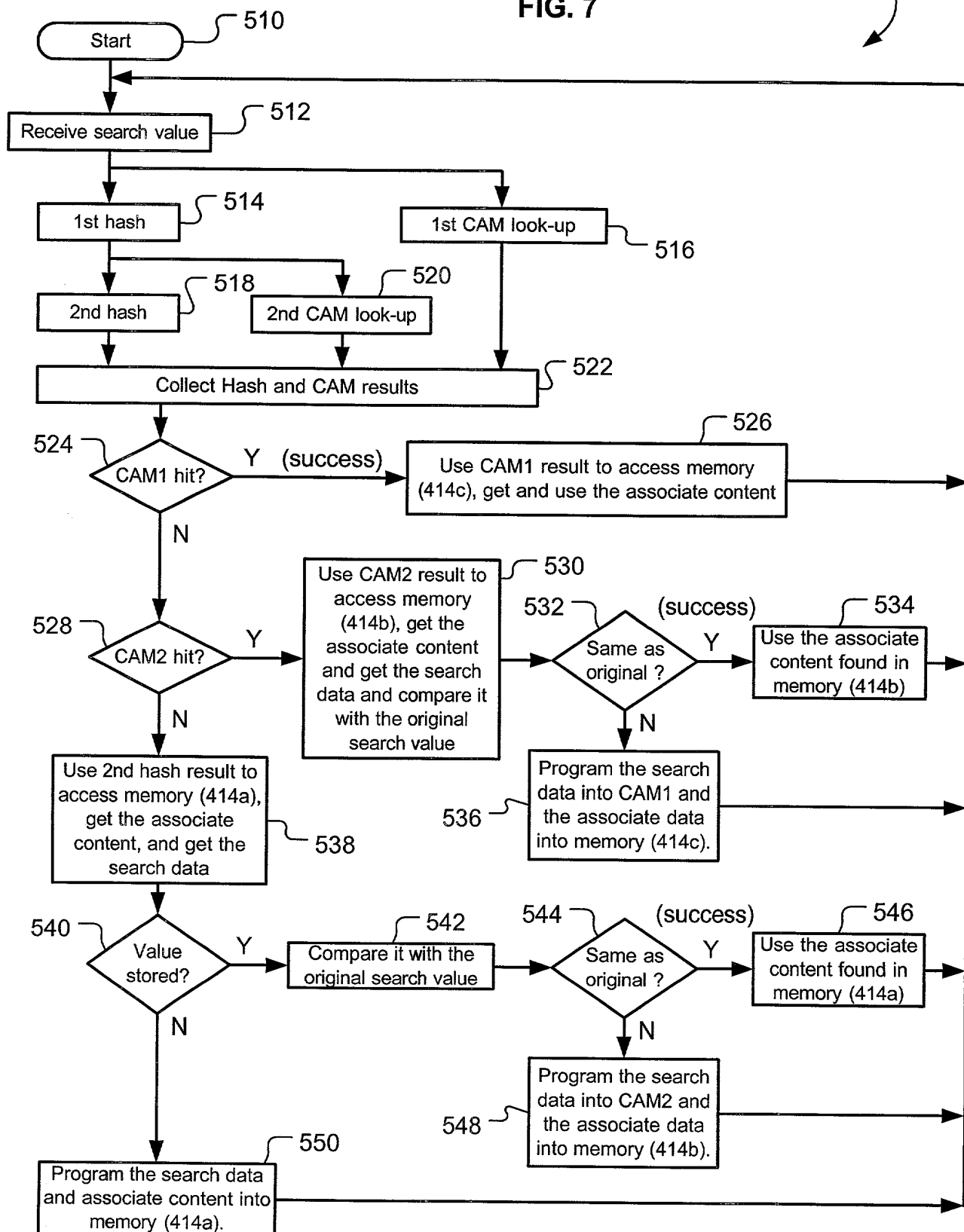
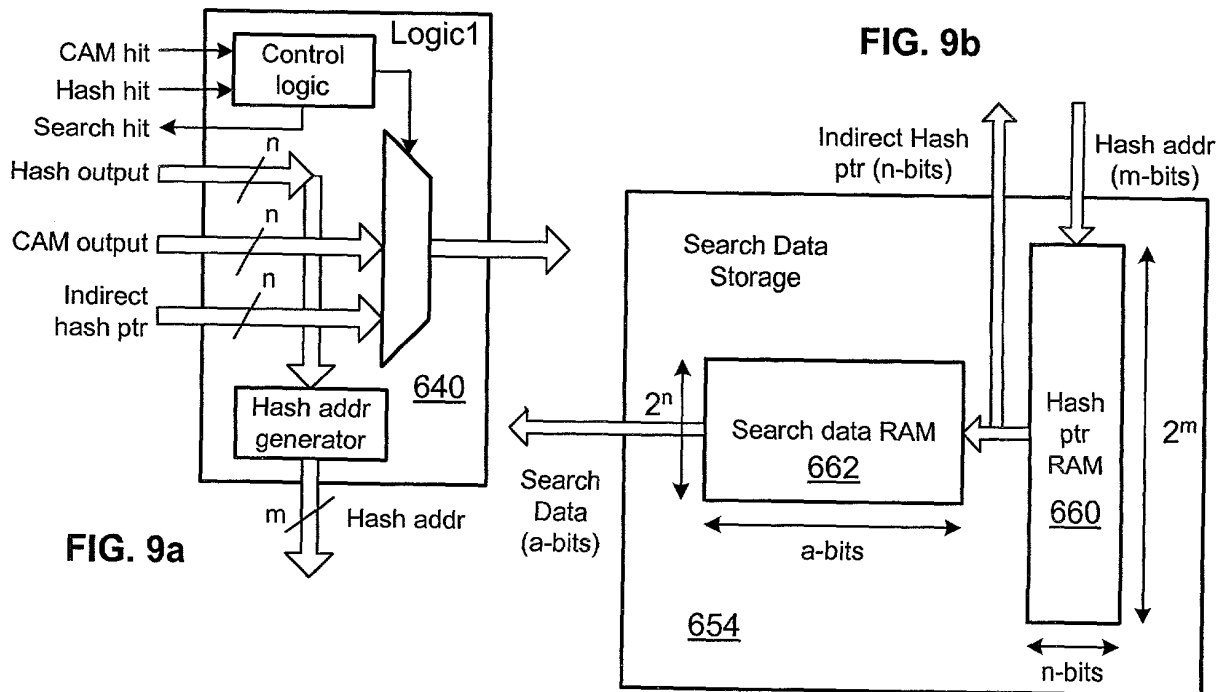
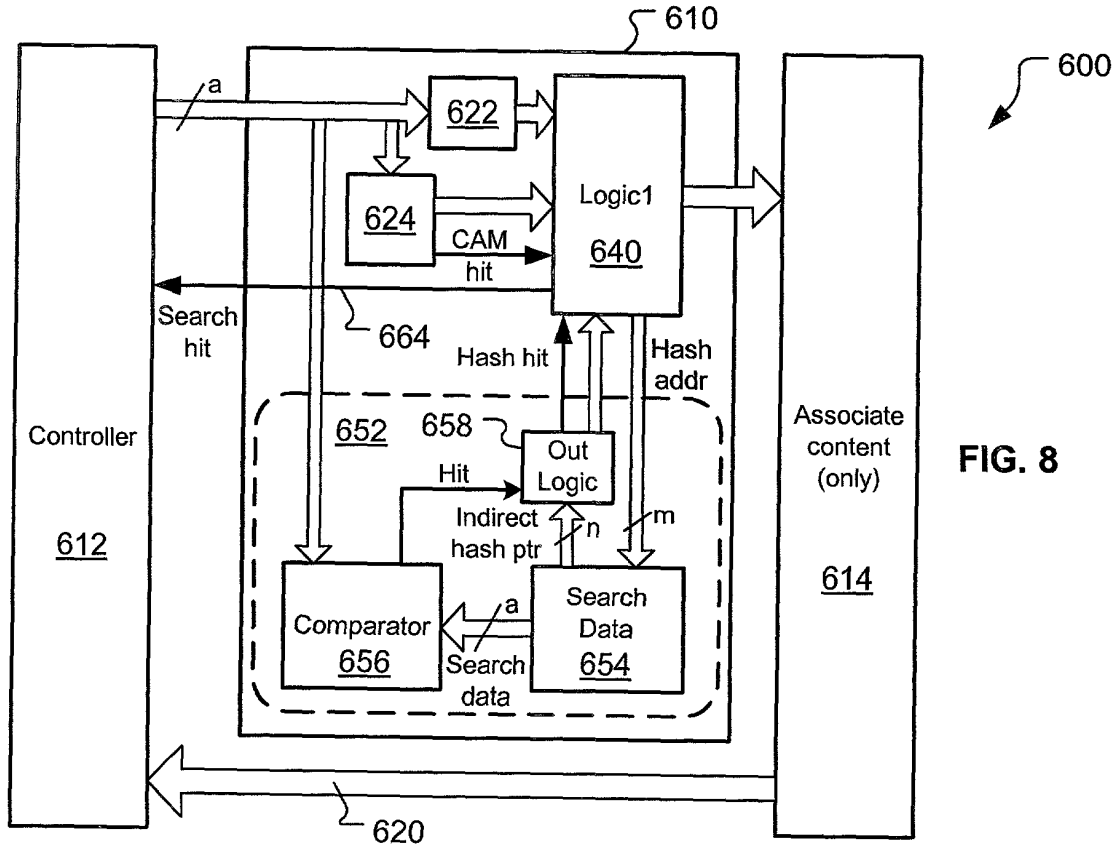
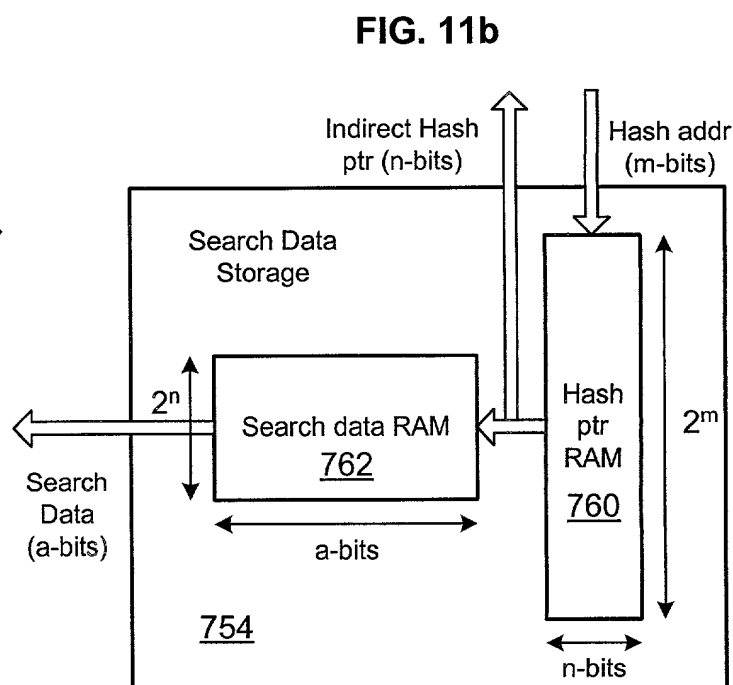
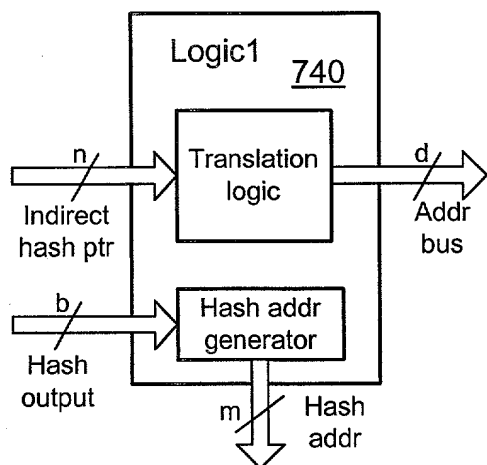
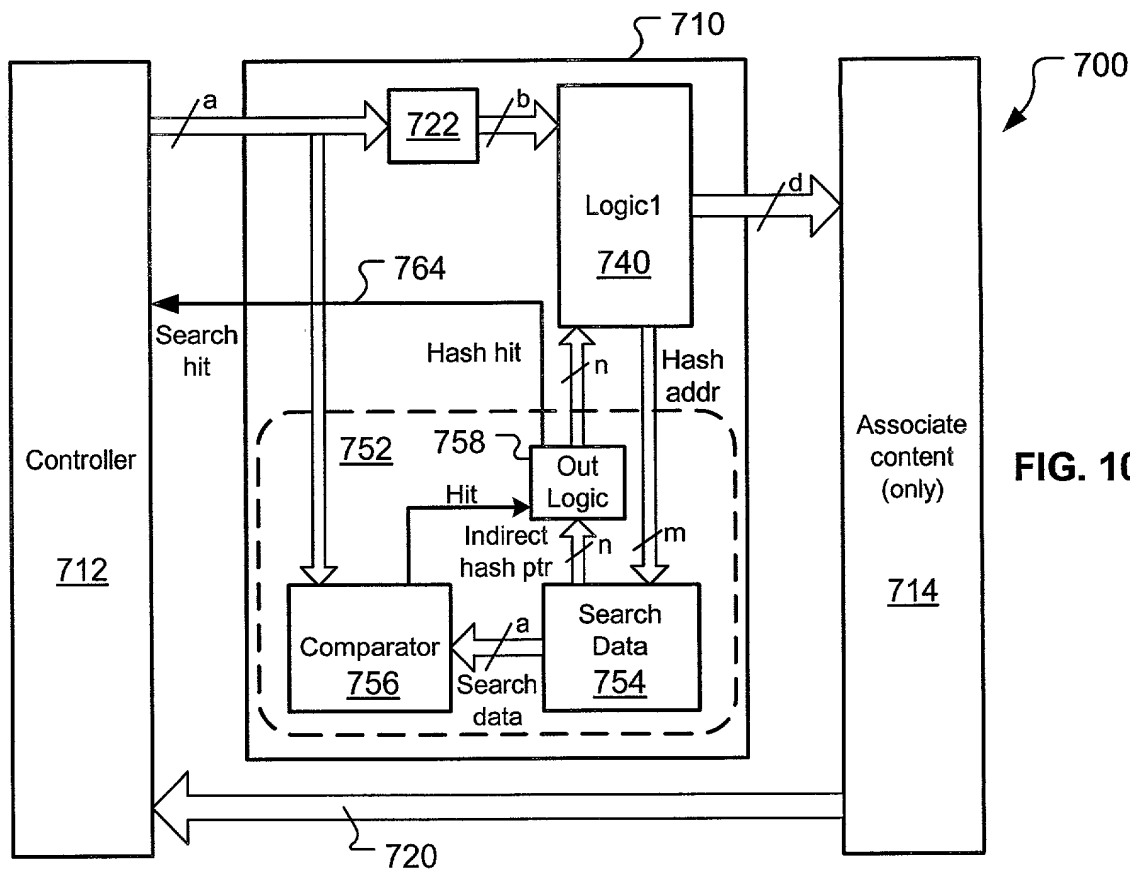


FIG. 7

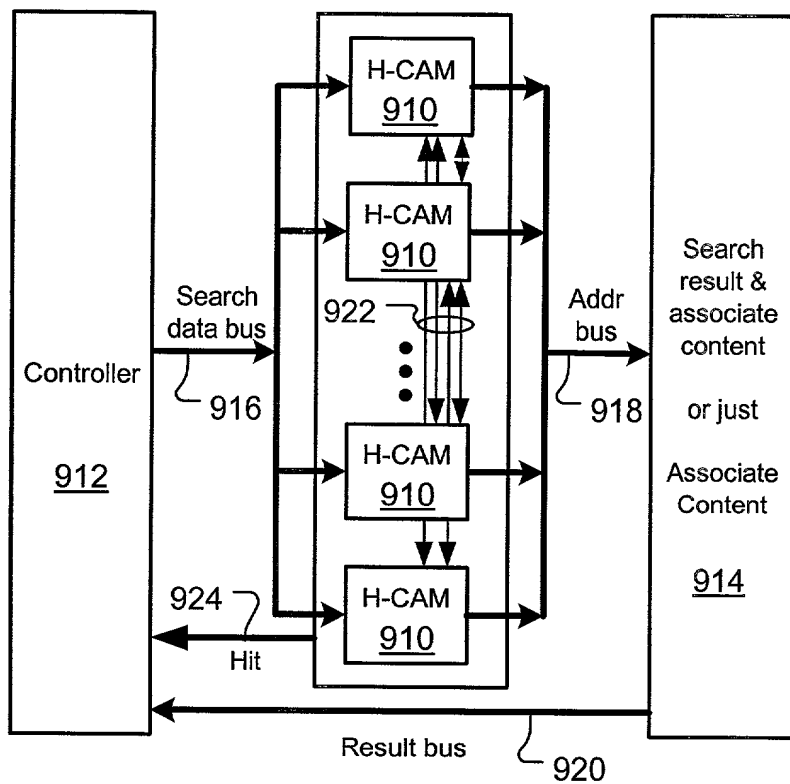
500



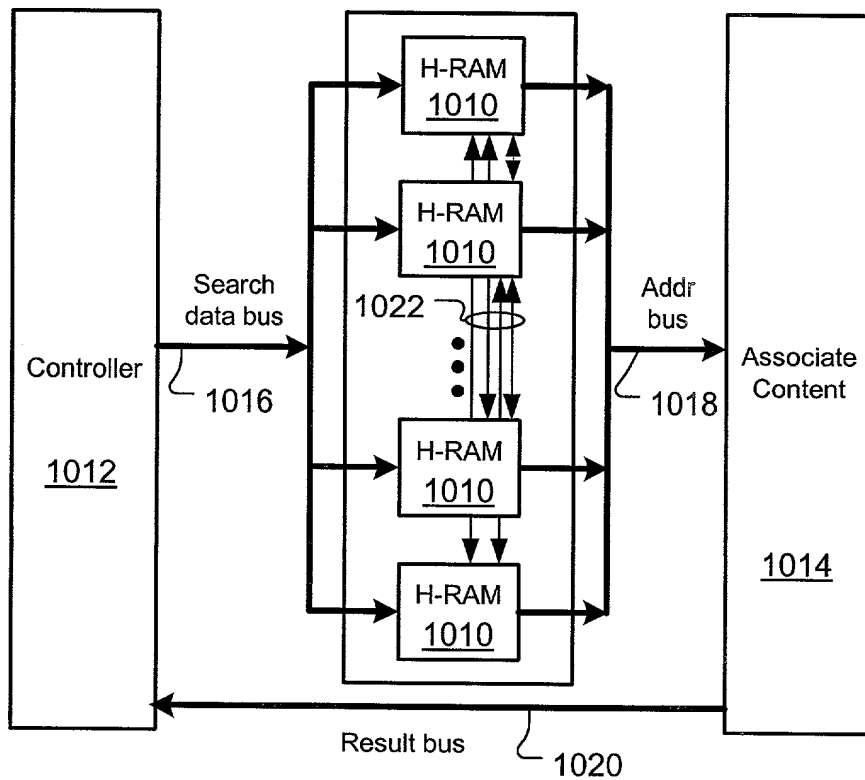






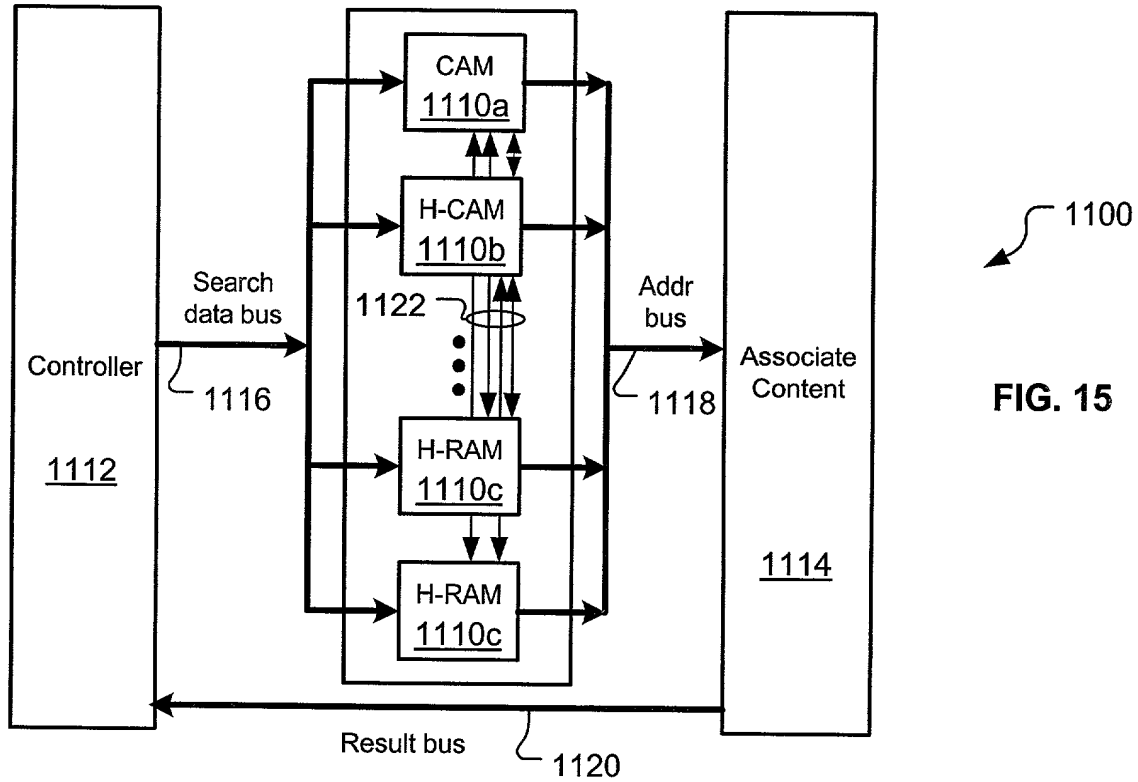


900
FIG. 13



1000
FIG. 14

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1100

FIG. 15